HYDROCARBON ENGINEERING

May 2018

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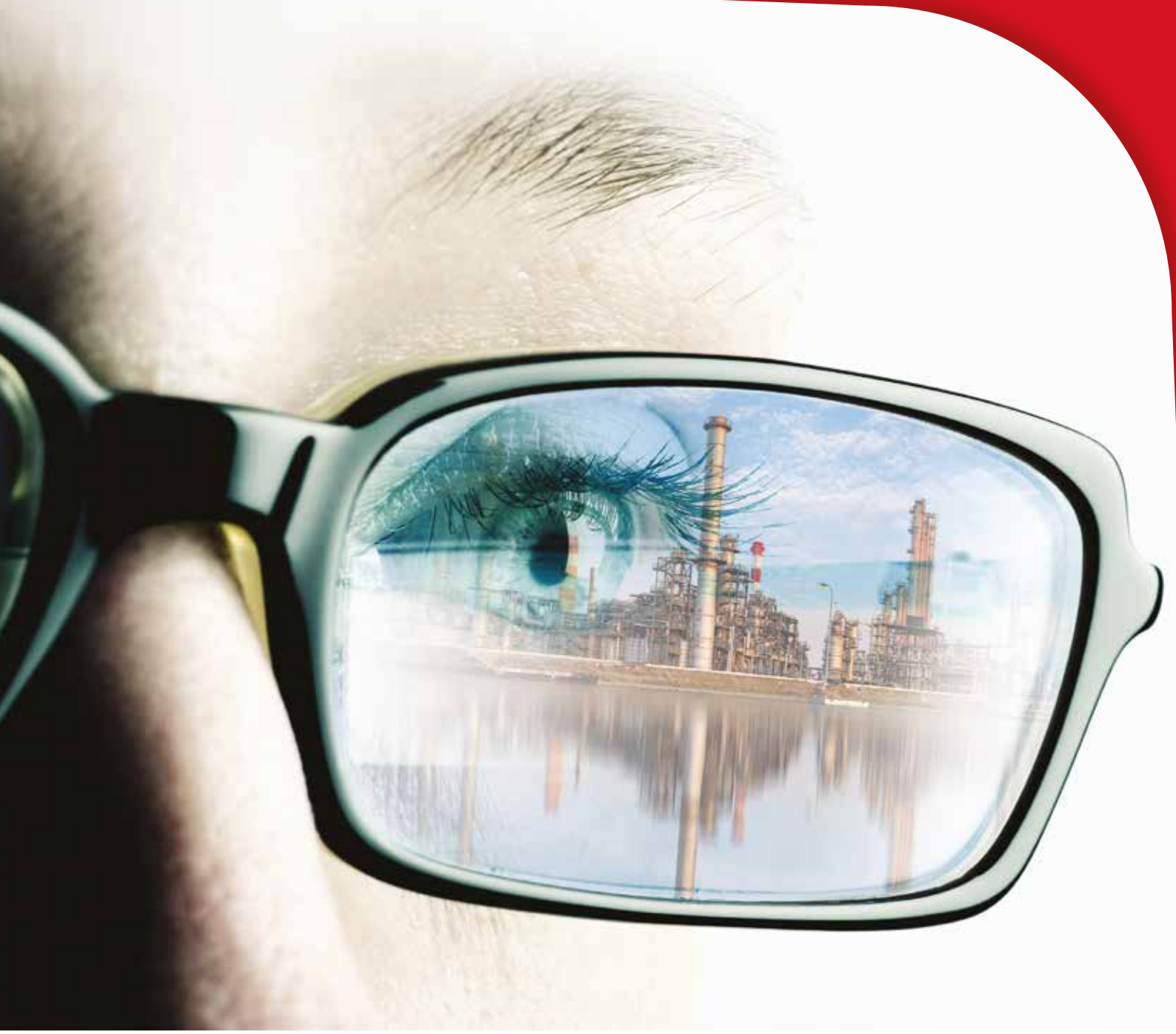

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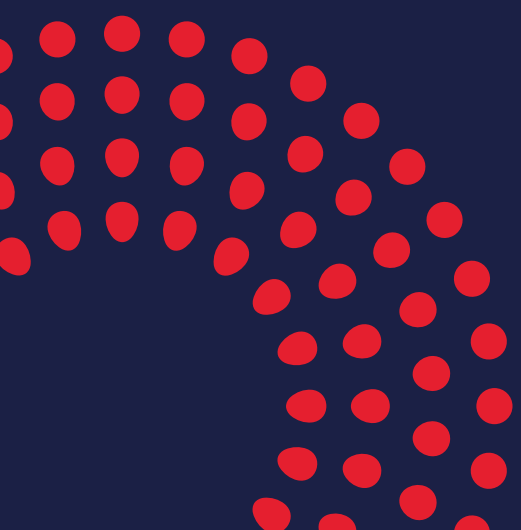

ipco

COMMENT

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SUBSCRIPTION RATES
Annual subscription £110 UK including postage /£125 overseas (postage airmail).
Two year discounted rate £176 UK including postage/£200 overseas (postage airmail).

SUBSCRIPTION CLAIMS
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APPLICABLE ONLY TO USA & CANADA
Hydrocarbon Engineering (ISSN No: 1468-9340, USPS No: 020-998) is published monthly by Palladian Publications Ltd GBR and distributed in the USA by Asendia USA, 17B S Middlesex Ave, Monroe NJ 08831. Periodicals postage paid New Brunswick, NJ and additional mailing offices. POSTMASTER: send address changes to HYDROCARBON ENGINEERING, 701C Ashland Ave, Folcroft PA 19032.

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HYDROCARBON ENGINEERING

CALLUM O'REILLY
EDITOR

The recent news that Motiva Enterprises, a wholly-owned subsidiary of Saudi Aramco, is taking its first steps towards a planned expansion into petrochemicals in the US is further evidence of a growing shift in the fortunes of the country's petrochemical sector.

Motiva has signed Memoranda of Understanding (MoU) worth US$8 – 10 billion with Honeywell UOP and TechnipFMC to study petrochemical production technology for use in a potential complex at its Port Arthur refinery in Texas. The deals follow SABIC's agreement with ExxonMobil, signed last year, to conduct a detailed study of the proposed Gulf Coast Growth Ventures project. The two companies have selected a site in San Patricio County, Texas, for a proposed petrochemical complex.

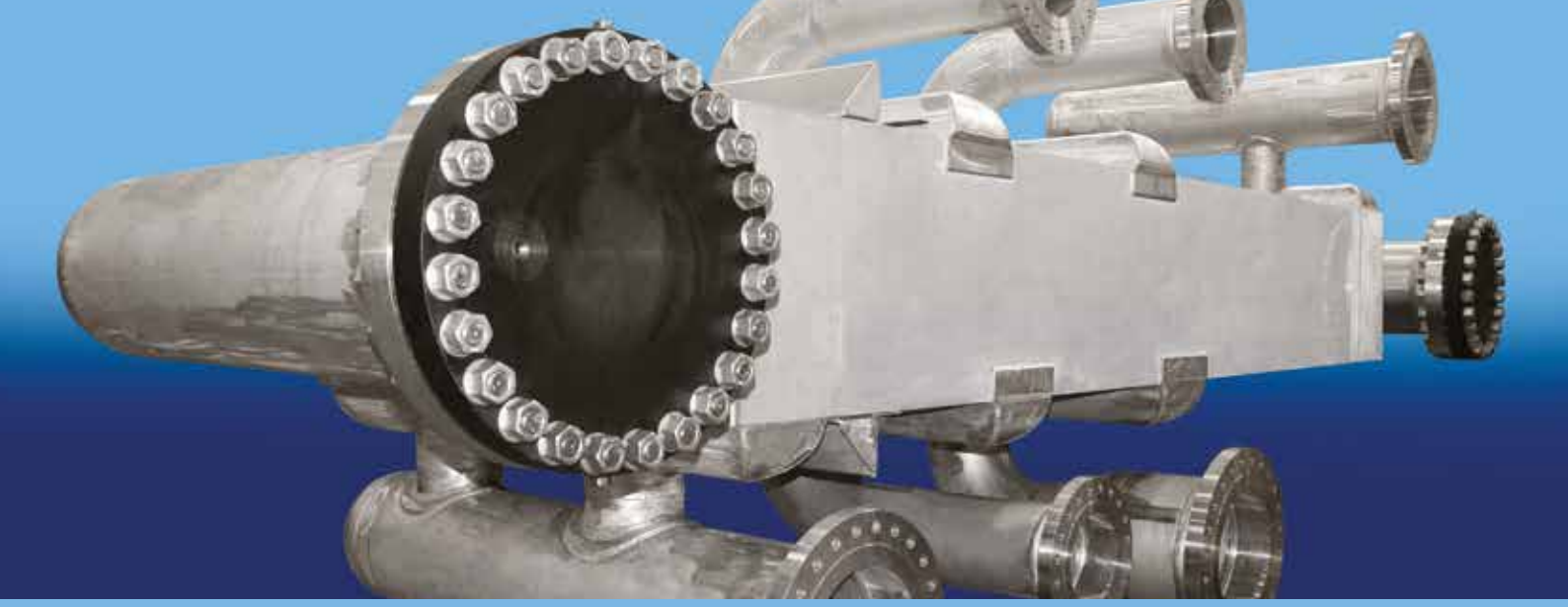
Increased interest from companies in the Middle East signals a remarkable turnaround for the US petrochemical sector. Quoting IHS Markit data, the *Houston Chronicle* reports that between 2000 and 2010, US petrochemical manufacturers closed more plants than they opened, while the Middle East added 37.4 million t of production capacity. Between 2011 and 2020, IHS Markit expects the US to outpace the Middle East with 27.9 million t of new production capacity.[1]

A report in *The Economist* attributes this dramatic change to two key factors. Firstly, a recent wave of 'portfolio reshaping', as companies spin off non-core businesses and bulk up in core areas, which produces huge firms that can take on state-sponsored international rivals. Secondly, the shale revolution is flooding the market with cheap raw materials for the production of chemicals.[2]

Despite the positive outlook for the US petrochemical sector, *The Economist* points to a number of hurdles that will need to be overcome if this remarkable rise is to continue, including the dangers of inadequate infrastructure, rising costs, and a lack of skilled workers due the sector's dormant decade at the start of this century. Perhaps the greatest concern, however, is the consequences of a potential trade war that is brewing between the US and China. According to *The Economist*, The Dow Chemical Company has said that President Trump's tariffs on Chinese steel and aluminium imports could add US$300 million to the cost of its new plants in Texas. And China appears to be targeting petrochemical products in its retaliatory tariff proposals. The CEO of the American Chemistry Council (ACC), Cal Dooley, said: "China is one of the US chemical industry's most important trading partners, importing 11%, or US$3.2 billion, of all US plastic resins in 2017. We are particularly concerned that 40% of the products to which China has assigned new tariffs are chemicals, including polyethylene, PVC, polycarbonates, acrylates, and others." Dooley notes that almost US$185 billion in new and expanded chemicals infrastructure is predicated on current tariff schedules, and raises concerns that market shifts as a result of tariff increases could result in investors doing their business away from the US. He is urging the US and China to "reach a productive and meaningful agreement" before any of the tariffs take effect.

As the report in *The Economist* astutely concludes: "It would be rum indeed if Mr Trump's efforts to support local heavy industry ended up derailing the ongoing revival of America's once-moribund chemicals sector."

1. BLUNT, K., 'Global petrochemicals growth shifts from Middle East to Gulf Coast', *Houston Chronicle*, (12 April 2018).
2. 'Cracking on', *The Economist*, (14 April 2018).



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GUEST COMMENT

CHET THOMPSON
PRESIDENT & CEO, AMERICAN FUEL & PETROCHEMICAL MANUFACTURERS (AFPM)

Fifteen months into the Trump administration and the outlook for the fuel refining and petrochemical manufacturing industries is incredibly strong. President Trump has ended the war on fossil fuels and signalled an openness to work in tandem with industry to utilise the full potential of the US' abundant resources to expand the nation's energy security. An agenda marked by thoughtful, smart policies and regulatory reform is strengthening the national economy and expanding our status both in the US and in the global marketplace.

Last year will be remembered for historic tax reform; the first major overhaul and modernisation of the US tax code in more than 30 years. Lowering corporate tax rate immediately made the US refining and petrochemical industries more globally competitive, and freed capital to be invested in facilities, infrastructure, and the workforce. Other provisions have led companies to announce plans to reshore manufacturing operations, a win for the US economy, the domestic fuel refining and petrochemical industries, as well as US workers looking for good, well-paying jobs.

We are also seeing real progress on regulatory reform. The US Environmental Protection Agency (EPA) is reviewing more than 60 regulations that have added unnecessary and duplicative burdens on industries with no real environmental benefit.

Tax and regulatory reform are game-changers, producing a pro-growth environment for industry and manufacturing to capitalise on.

Over the past decade, the US has been experiencing a shale revolution. Once reliant on foreign sources, the US exported 80 billion gal. of refined products to 100 countries in 2017. Not only has this abundance of resources made the US more energy secure and a leading exporter, the country is now one of the preferred locations for refining and petrochemical manufacturing.

> "Having the good fortune of enormous amounts of oil and natural gas is not enough without an efficient and cost-effective infrastructure system."

However, having the good fortune of enormous amounts of oil and natural gas is not enough without an efficient and cost-effective infrastructure system. We must be able to move feedstocks to facilities and get our products to market, both domestically and internationally, by pipeline, rail, road, ports and waterways. Just recently, the administration gave reason to be optimistic, with a proposed US$1.5 trillion in investments to improve US infrastructure. AFPM will be working to ensure that energy infrastructure remains a top priority for this administration and Congress.

Financial considerations are not the only obstacles; a permitting process that moves at a glacial pace is a significant deterrent. President Trump noted in his last State of the Union address that if the Empire State Building could be built in a year, it should not take a decade to obtain a permit to construct a pipeline or road. AFPM fully supports the President's call to streamline the permitting process for critical infrastructure. The current process must be changed if the US is to become the global leader in energy development.

Meaningful headway on efforts to reform the Renewable Fuel Standard have also been seen. Productive discussions are happening in the House, the Senate, and within the administration. There are stakeholders at the table who, for the first time, are open to real discussions about commonsense proposals that allow all liquid transportation fuels to compete in a free and open marketplace.

The right policies are essential if the US refining and petrochemical industries are to continue to grow and meet the increasing global demand for life-improving products. These types of opportunities do not come around often so the US cannot afford to squander them.


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WORLD NEWS

Italy | Merichem supplies SRU to Eni refinery

Merichem Co. has won an order to supply a LO-CAT® sulfur recovery unit (SRU) to Eni's Gela Refinery in Sicily.

Basic engineering is already complete, and equipment is on order. Completion of the installation is anticipated in summer 2018.

Eni's Green Refinery Project at the Gela Refinery is part of the company's commitment to the European Union's Renewable Energy Directive, which set challenging targets for reduced emissions by the end of 2020. The refinery will utilise Ecofining™ technology, developed by Eni to produce green diesel. The technology is part of the conversion of the idle plant to a biorefinery, which will produce green refinery products from renewable sources. As a byproduct, the conversion process produces small amounts of hydrogen sulfide (H_2S) that must be removed to meet strict environmental standards.

The LO-CAT process is a wet scrubbing, liquid redox system that uses a chelated iron solution to convert H_2S to innocuous, elemental sulfur. It does not use toxic chemicals and does not produce any hazardous waste byproducts. The catalyst is continuously regenerated in the process, so less catalyst is consumed.

Argentina | Shell sells downstream business to Raízen

Shell has signed an agreement to sell its downstream business in Argentina to Raízen (a joint venture between Shell and Cosan) for US$0.95 billion in cash proceeds at completion, subject to customary closing conditions.

The sale includes the Buenos Aires Refinery, around 645 retail stations, LPG, marine fuels, aviation fuels, bitumen, chemicals and lubricants businesses, as well as supply and distribution activities in the country.

After the transaction closes, the businesses acquired by Raízen will continue its relationships with Shell through various commercial agreements, which represent an estimated value of US$0.3 billion.

The agreement with Raízen is the result of a competitive bidding process and the sale is expected to be completed later this year.

The deal offers the opportunity to consolidate a regional partnership between Shell and Cosan.

Malaysia | Petronas delivers first LNG cargo to S-OIL Corp.

Petronas, through its subsidiary, Petronas LNG Ltd, has successfully delivered its first cargo of LNG to South Korean oil refining company, S-OIL Corp.

The delivery marks the beginning of Petronas LNG Ltd's supply to S-OIL via a 15-year sale and purchase agreement (SPA). Under the agreement, Petronas LNG Ltd is committed to deliver up to 0.7 million tpy of LNG to S-OIL.

The cargo was delivered from Petronas' LNG Complex in Bintulu, Sarawak, Malaysia, to POSCO Gwangyang Terminal in South Korea via the *Puteri Zamrud Satu* LNG carrier, which is chartered by Malaysia LNG (MLNG) and operated by Petronas' subsidiary, MISC Berhad (MISC).

Petronas' Vice President of LNG Marketing and Trading, Ahmad Adly Alias, attributed the success of the LNG delivery to the efficient and effective collaboration between Petronas, S-OIL, POSCO and MISC, in ensuring all operational challenges were addressed effectively.

USA | CB&I modularises ethylene heaters for ethane project

CB&I has achieved three significant project milestones at its Lotte Chemical (LACC) ethane cracker project in Lake Charles, Louisiana. The company has successfully set the first three of the four major modules at the project so far.

This is the first time CB&I has modularised its SRT® ethylene heaters, which are key components of the ethane cracker that will be used to produce approximately 1 million tpy of ethylene. The successful modularisation, delivery and installation of the modules also marks the first time this has been executed in the US in terms of size and complexity.

The LACC project team has also achieved an impressive safety record. To date, CB&I has safely executed more than 4.5 million work hours without a lost time incident.

WORLD NEWS

IN BRIEF

THAILAND

Hyundai Engineering Co. has won an engineering, procurement and construction contract from Bangchak Corp. Public Co. Ltd (BCP) to build continuous catalyst regeneration reformers and replace old hydrocracking units at the oil refinery in the Phra Khanong district of Bangkok. The new facilities would allow the production of premium high-octane petrol, while the replaced hydrocracking units would boost the capacity of the refinery from 25 000 bpd to 27 500 bpd.

USA

Praxair Inc. has begun supplying hydrogen to Marathon Petroleum Corp.'s (MPC) refinery in Garyville, Louisiana. The hydrogen is being supplied through a recently-commissioned extension to Praxair's Southeast Louisiana pipeline network, and is being used by MPC in an ultra-low-sulfur diesel project. The Garyville refinery is the last major grassroots refinery that was built in the US and is the third-largest operating in the country today.

NORWAY

Wood has secured a new contract under an existing framework agreement. The company is delivering front-end engineering design (FEED) for Statoil's Mongstad refinery near Bergen. The scope of the contract includes the design, engineering and analysis for modifications to reduce sulfur content in gasoline produced at the refinery.

CHILE

KBR Inc. has been awarded a license and basic engineering design contract by ENAP Refinerías SA to utilise KBR's ROSE® solvent deasphalting technology at its Bío Bío refinery in Concepcion.

USA | Honeywell provides cryogenic gas processing plant to Caprock Midstream

Honeywell's UOP Russell business will provide a high-recovery cryogenic gas processing plant to Caprock Midstream LLC for its Pecos Bend facility in West Texas. The new plant is designed to extract 99% of ethane and 100% of propane and heavier hydrocarbons from natural gas in the Permian Basin.

The UOP Russell solution includes the design, supply and installation of a modular cryogenic plant, refrigeration, dehydration and acid gas removal units; a facility control system; flare system; and required electrical equipment. The turnkey plant design streamlines project schedules and is preconfigured for the specific gas composition in that location. The plant will also use Process Insight Reliability Advisor, a Honeywell Connected Plant service that provides ongoing monitoring, as well as early event detection and mitigation of performance issues.

The plant uses an advanced cycle Recycle Split Vapor (RSV) process to recover NGLs from feed gas for use as petrochemical feedstocks, enhancing the value of feed gas supplied to Caprock by independent gas producers. The plant is designed to accommodate the NGL-rich gas in Pecos County.

Papua New Guinea | ExxonMobil LNG plant safely resumes operation

Production of LNG has safely resumed at ExxonMobil's PNG LNG project. This follows a temporary shutdown of operations after a severe earthquake occurred in the region on 26 February. At the time of writing, LNG exports were expected to resume soon.

While one of the plant's trains is currently operating near Port Moresby, its second train is expected to restart as production is increased over time.

During the period that production was shut-in, ExxonMobil was able to complete unrelated maintenance scheduled for later in the year to allow for more efficient operations in the months ahead.

USA | BASF and Nalco Water ink processing and refining agreement

BASF Corp. has entered an exclusive distribution agreement with Nalco Water, an Ecolab company, to provide gas treatment solutions to the US gas processing and refining industries. Under the agreement terms, Nalco Water will combine BASF's gas treating amines with its technology and on-site expertise to offer customers solutions to drive operational efficiency and value.

"This combined offering will enable gas processors to improve their amine systems' operational performance and efficiency by benefiting from the advanced technologies and customer-focused service model that comes with BASF's extensive experience in gas treatment," said Jeff Bulischeck, Executive Vice President and General Manager, Global Heavy Industry and Mining for Nalco Water.

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WORLD NEWS

IN BRIEF

USA
W. R. Grace & Co. has completed the acquisition of the Polyolefin Catalysts business of Albemarle Corp. for US$416 million. The acquisition includes production plants in Baton Rouge, Louisiana, and Yeosu, South Korea; R&D and pilot plant capabilities; and an extensive portfolio of intellectual property.

BRAZIL
BP and Petróleo Brasileiro S.A. (Petrobras) have signed a Memorandum of Understanding (MoU) to explore areas of cooperation. The companies have committed to exploring potential joint commercial agreements in upstream, downstream, trading, and across low carbon initiatives, inside and outside of Brazil. The alliance is also expected to include the transfer of technology, as well as joint training and research.

CHINA
hte – the high throughput experimentation company – is set to equip CNOOC Research Institute of Refining and Petrochemicals with a high throughput catalyst testing system for hydroprocessing applications. The system will be completed in 2018 and installed at CNOOC's new laboratory in Beijing Future Science & Technology Park.

USA
Cyberhawk has been awarded a three-year contract by an oil and gas supermajor to provide a digital asset management solution during the construction of its new world-scale petrochemical complex in the US. Cyberhawk was chosen to provide drone content management and distribution services to allow a digitised view of drone-captured data, such as orthophotos, spherical images, 3D point cloud models and videos, collected on-site on a weekly basis.

USA | Meridian and EPC provider sign LOI

Meridian Energy Group Inc. has signed a letter of intent (LOI) with a leading specialty engineering, procurement and construction (EPC) solutions provider based in Houston, Texas, to initially complete a front-end engineering and design (FEED) study for the Davis Refinery in Belfield, North Dakota.

The LOI establishes the terms and conditions under which Meridian would contract with the contractor for the EPC of the initial phase of the Davis Refinery.

This LOI comes at a critical point, as Meridian prepares to receive the final issuance of the permit to construct (PTC) for the Davis Refinery from the North Dakota Department of Health (NDDoH) in the coming weeks.

Meridian is confident that the contractor is an ideal EPC partner to carry out and implement the detailed design and engineering of the Davis Refinery and the standard of emission controls the facility will set for the refining industry moving forward.

Saudi Arabia | SNC-Lavalin awarded contract for Saudi Aramco gas plant

SNC-Lavalin has been awarded a multi-million dollar contract by Saudi Aramco for the installation of additional facilities for a major gas processing facility in Saudi Arabia's Eastern Province.

Under the contract, SNC-Lavalin will construct the Arabiah condensate handling facility and sour water disposal unit project at the Wasit Gas Plant, including the installation of process equipment as well as related civil and structural, piping, electrical, and instrumentation and control systems. Work is already underway with a target completion date of late 2019.

Wasit Gas Plant is one of the largest gas plants to come onstream in Saudi Arabia, and is an enabler for the Kingdom's Vision 2030 economic roadmap.

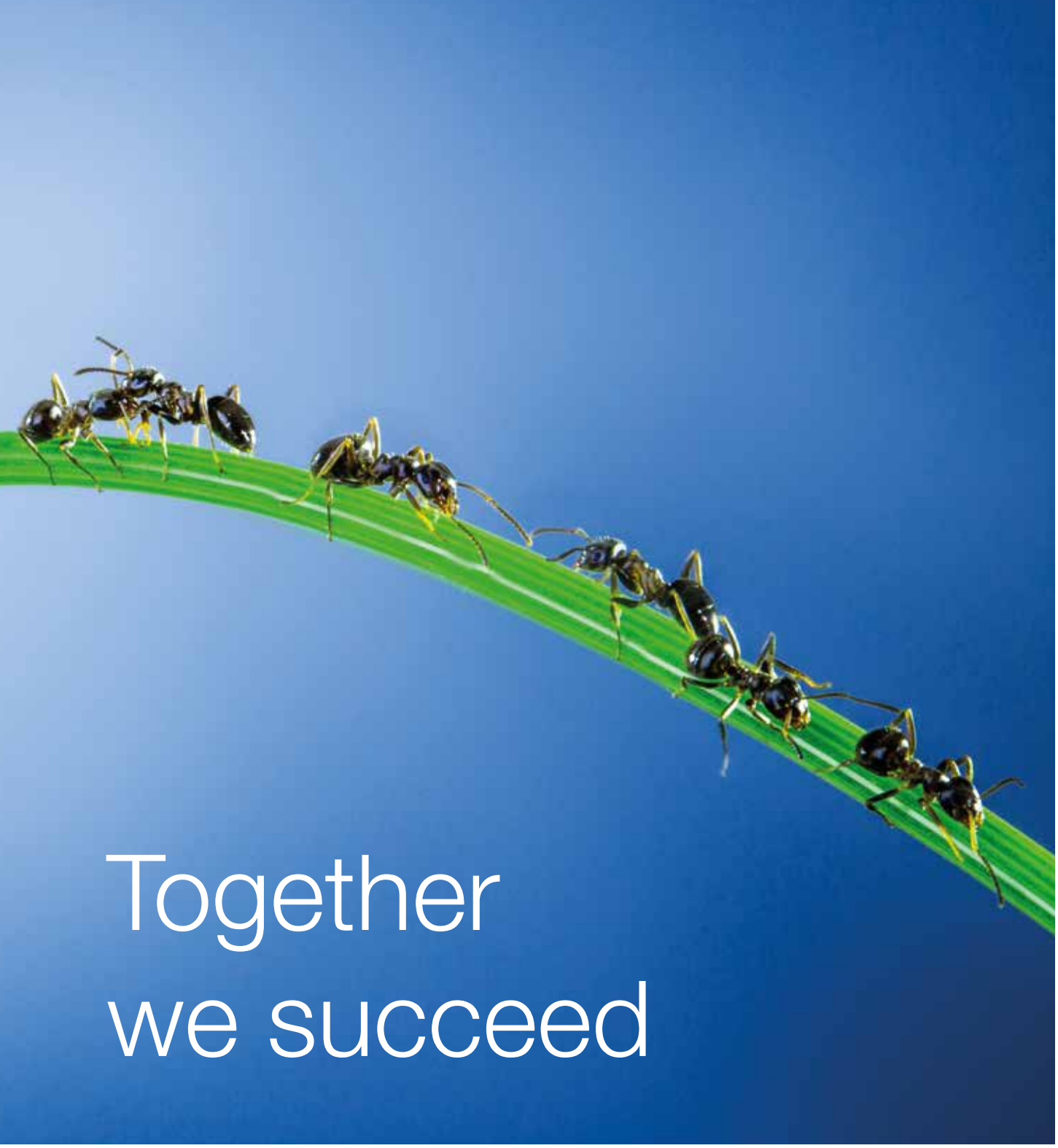
USA| Air Liquide and LyondellBasell sign oxygen supply agreement

Air Liquide recently signed a new long-term agreement with LyondellBasell to supply oxygen to a new large-scale petrochemical plant, which will be constructed in Channelview, Texas.

LyondellBasell's new propylene oxide/tertiary butyl alcohol (PO/TBA) plant is expected to be the largest plant of its kind in the world when completed.

The oxygen provided by Air Liquide will be sourced from its Gulf Coast Pipeline System, part of the largest industrial gas pipeline system, which spans more than 2000 miles along the coasts of southeast Texas and Louisiana.

LyondellBasell's US$2.4 billion PO/TBA project is part of its announced organic growth programme. The PO/TBA portion of this investment is designed to meet rising global demand for both urethanes and cleaner-burning oxyfuels. The construction of the new PO/TBA plant is expected to begin in 2H18 and be completed in 2021.



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WORLD NEWS

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San Antonio, Texas, USA
www.afpm.org/conferences

22 - 25 May 2018
International Downstream Week
Prague, Czech Republic
www.europetro.com

31 May - 1 June 2018
Downstream Conference & Exhibition
Galveston, Texas, USA
www.downstreamevent.com

11 - 13 June 2018
ILTA International Operating Conference & Trade Show
Houston, Texas, USA
www.ilta.org/aocts

11 - 15 June 2018
ACHEMA 2018
Frankfurt, Germany
www.achema.de

12 - 14 June 2018
Global Petroleum Show 2018
Calgary, Canada
www.globalpetroleumshow.com

25 - 29 June 2018
World Gas Conference 2018
Washington DC, USA
www.wgc2018.com

13 - 14 September 2018
11th EFRC Conference
Madrid, Spain
www.recip.org

9 - 11 October 2018
Asia Downstream Week
Bangkok, Thailand
www.europetro.com

China | CB&I wins ethylene technology contract

CB&I has been awarded an ethylene technology contract by Lianyungang Petrochemical Co. Ltd, a subsidiary of Zhejiang Satellite Petrochemical Co. Ltd.

The scope of work includes a process design package, heater engineering and technology license for two ethylene plants at Lianyungang's petrochemical facility in Jiangsu Province.

This design will utilise CB&I's low-cost ethane cracker flowsheet, which reduces investment costs by eliminating plant equipment.

Once complete, these will be China's first ethylene plants to crack 100% ethane feed, signifying a new wave of ethylene projects fed by shale gas ethane sourced from the US. Currently, all large ethylene plants in China crack mixed feeds or liquid feeds.

Oman | Mammoet completes work for petrochemical project

Mammoet has successfully completed the safe transport and installation of four 1180 t NGL bullet tanks for the Liwa Plastics Industries Complex (LPIC) project, a petrochemical project in Oman that is owned by Orpic.

The bullets, each measuring 60 m in length and 7.8 m in dia., were positioned on sand beds in a synchronised tandem lift utilising a 1600 t PTC ring crane and a 1200 t crawler crane. The small footprint enabled the PTC 35 DS crane to work within the limited area onsite utilising the available space as efficiently as possible.

Mammoet has been providing ongoing heavy lifting and transport solutions for this petrochemical project since 2017.

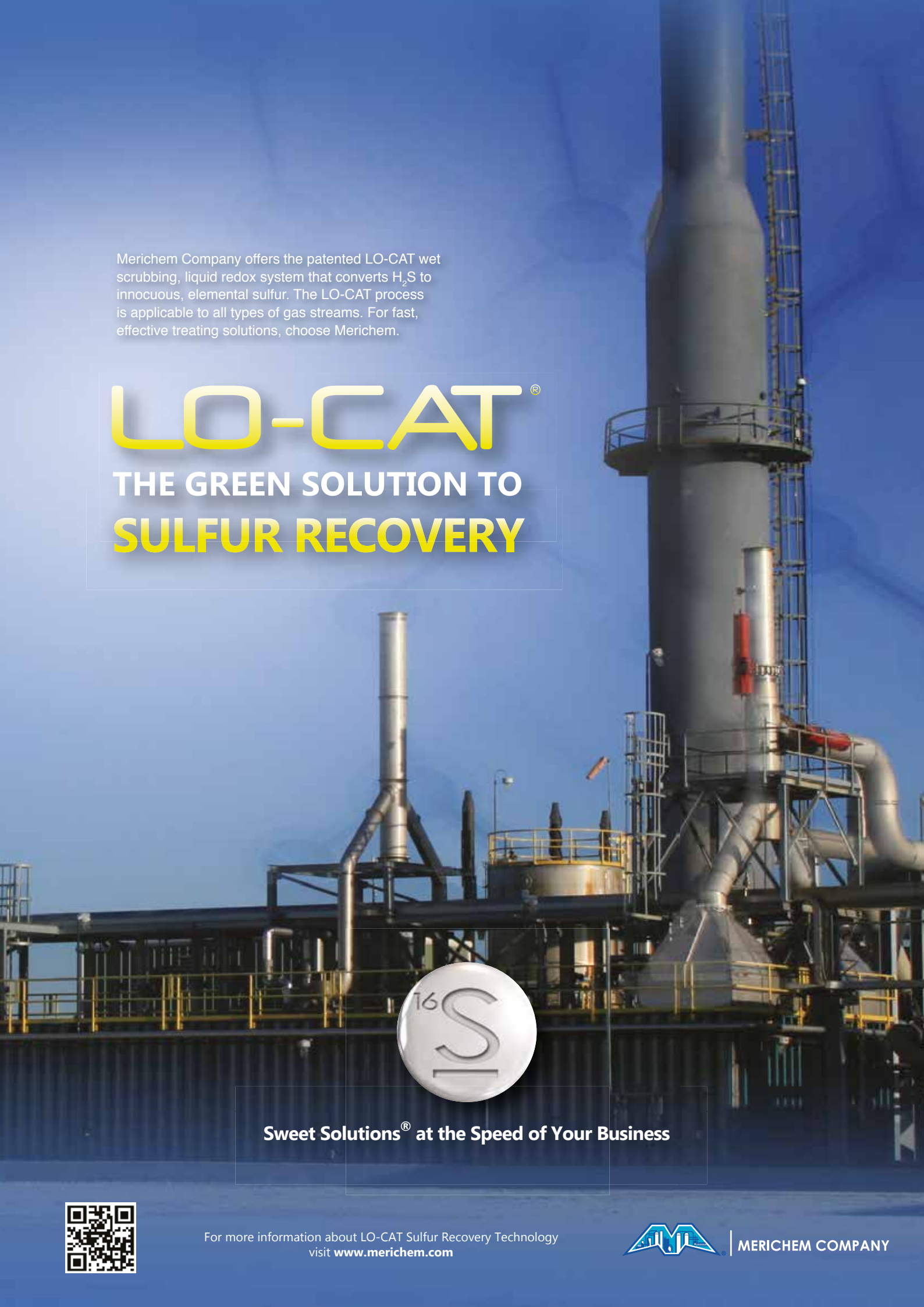
Upon commissioning in 2020, LPIC will transform Orpic's product mix and business model, double the company profit, create new business opportunities, generate significant employment opportunities, and support the development of a downstream plastics industry in Oman.

USA | Fluor awarded MPC refinery contract

Fluor Corp. has been selected by a division of Marathon Petroleum Corp. (MPC) to execute the engineering and procurement scope for MPC's South Texas Asset Repositioning (STAR) programme at its Galveston Bay refinery in Texas City, Texas. Fluor booked the undisclosed contract value into backlog in 1Q18.

The STAR programme further integrates MPC's former Texas City refinery into the adjacent Galveston Bay refinery, which is now the second largest refinery in the US. It will improve the facility's efficiency and reliability by increasing the residual oil processing capabilities, upgrading the crude unit and integrating facility logistics.

Fluor has been engaged in the STAR programme since 2013, performing the feasibility studies and early engineering work. The company is currently providing engineering, procurement and construction management services that will allow the Galveston Bay refinery to achieve US Environmental Protection Agency Tier 3 gasoline sulfur standards.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Wat Arun Temple at twilight in Bangkok, Thailand.

SOUTHEAST ASIA: A DOWNWARD SPIRAL

Ng Weng Hoong, Contributing Editor, explores why Southeast Asia's oil self-sufficiency is in decline.

If Southeast Asia's 10 countries were to merge to become a new nation, it would have the world's third largest population and the sixth largest economy. The region's 640 million population would be behind China and India in size, while its combined GDP of nearly US$2.6 trillion would be larger than that of France but smaller than that of the UK.

Comprising Indonesia, the Philippines, Vietnam, Thailand, Myanmar, Malaysia, Cambodia, Laos, Singapore and Brunei, Southeast Asia has seen its influence expand on the world stage over the last two decades. Between 1996 and 2016, its population grew at an annual rate of 1.33% to outpace the global rate of 1.24%, while its economy expanded by 6.41% per year, compared with a global rate of 4.48%.

However, like the region's other major economies, Southeast Asia faces a worrying future of declining energy self-sufficiency on account of its rising domestic consumption and depleting oil and gas reserves. Growing at an annual rate of nearly 3.2%, the region's oil consumption rose from 3.34 million bpd in 1996 to nearly 6.25 million bpd in 2016. Over the same period, its oil production fell from 2.74 million bpd to 2.55 million bpd, with an annual decline rate of 0.35%.

Southeast Asia's decline as an oil-producing region has been led by its two biggest players. Indonesia's production has plunged from 1.58 million bpd to 881 million bpd, while Malaysia has seen its crude supply fall from 716 000 bpd to 705 000 bpd between 1996 and 2016.

Table 1. Southeast Asia's population and GDP (source: World Bank)

	1996 population (million)	2016 population (million)	1996 GDP (US$ billion)	2016 GDP (US$ billion)
Indonesia	200	261	227.4	932.3
Philippines	71	103	82.9	304.9
Vietnam	73	93	24.7	202.6
Thailand	60	69	183	406.8
Myanmar	44	53	11.3	67.4
Malaysia	21	31	101	296.4
Cambodia	11	16	3.5	20
Laos	5	6.8	1.9	15.9
Singapore	3.7	5.6	96	297
Brunei	0.3	0.4	5.1	11.4
Southeast Asia	**490**	**638.8**	**736.8**	**2554.7**
World	**5832**	**7467**	**31 554**	**75 848**

Table 2. Southeast Asia's oil consumption ('000 bpd) (sources: BP, US Department of Commerce, IEA)

	1996	2006	2015	2016
Indonesia	924	1244	1592	1615
Thailand	792	996	1355	1382
Singapore	612	848	1336	1382
Malaysia	445	660	814	829
Philippines	358	283	398	434
Vietnam	114	254	407	431
Myanmar	24	32	101	107
Rest of Southeast Asia*	26	48	62	65
Total	**3340**	**4365**	**6065**	**6245**

* Brunei, Cambodia and Laos

Table 3. Southeast Asia's oil production ('000 bpd) (sources: BP, US Department of Commerce, IEA)

	1996	2006	2015	2016
Indonesia	1580	1018	841	881
Malaysia	716	713	699	705
Thailand	96	326	468	479
Vietnam	179	354	362	333
Brunei	165	221	127	121
Myanmar	n/a	n/a	16	16
Philippines	n/a	n/a	15	15
Total	**2736**	**2632**	**2528**	**2550**

As a result, the International Energy Agency (IEA) expects Southeast Asia's net crude imports to "grow substantially, from 2.1 million bpd today to 5.5 million bpd by 2040."

The region has largely benefitted from the recent plunge in oil prices and fierce competition among producers for buyers. However, the IEA warns of a day of reckoning, when consumers must prepare for the market's "eventual rebalancing, higher prices and the region's ever-increasing import needs."

Low oil prices, political risks undermine investment climate

Hobbled by the recent weakness in energy prices and Asia's rising political risk, Southeast Asia is struggling to attract investments into its once vibrant oil and gas sector.

Indonesia's decline has been the most dramatic, with the government failing to convince both foreign and local investors that it is a business-friendly jurisdiction. Its oil reserves have plunged by 25%, from 4.4 billion bbls in 2006 to 3.3 billion bbls in 2016. The loss of confidence in Indonesia was a major reason for the fall in Southeast Asia's proven oil reserves, from 14.9 billion bbls to 13 billion bbls between 2006 and 2016.

The IEA expects Indonesia's oil output to fall to approximately 510 000 bpd in 2040 as it is failing to replace its mature fields and undertake enhanced oil recovery (EOR) projects.

Malaysia has fared worse than Indonesia, with its oil reserves falling from 5.4 billion bbls to 3.6 billion bbls in 1996 – 2016. It is hoping that a set of taxes and waivers introduced in 2013 will attract new investments into the country's marginal fields.

With its oil reserves surging by one-third, to 4.4 billion bbls in the decade to 2016, Vietnam has overtaken Indonesia and Malaysia to become the region's surprise leader. However, Vietnam has also seen its production fall over the past decade – to around 333 000 bpd in 2016 and 310 000 bpd today.

"This is because the largest producing fields, Bach Ho, Rong and Rong Se, are all in decline. Efforts to develop new fields have been hindered in recent years by the low oil price environment," according to the IEA.

Indonesia

Indonesia is becoming less dependent on energy exports, evident from its 2017 trade surplus reaching a five-year high of US$11.83 billion, despite the continuing decline in its oil and gas sales.

According to the Bank of Indonesia, the country posted a 34.6% rise in earnings from non-hydrocarbon exports that more than offset the 52% surge in its oil and gas trade deficit. Indonesia's trade gained from the growth in iron, steel, nickel and mineral ores exports that boosted last year's non-oil and gas surplus to US$20.4 billion. However, the oil and gas deficit, on account of rising imports and declining exports, rose from US$5.64 billion in 2016 to US$8.57 billion in 2017.

With oil and gas prices surging to their highest levels since late 2014, the Bank of Indonesia expects the country's trade position to further strengthen this year. "The trade balance performance is expected to improve in line with

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EXXONMOBIL TO SUPPLY IMO COMPLIANT FUELS

ExxonMobil has announced that it will supply fuels that comply with the International Maritime Organization's (IMO) 0.5% sulfur cap in ports in Northwest Europe, the Mediterranean and Singapore. The company will also announce additional locations throughout 2018.

HONEYWELL TO EXPAND MANUFACTURING FACILITY

Honeywell Process Solutions (HPS) has announced the expansion of its Fulgaon manufacturing facility in Pune, India, to meet the growing demand for automation solutions and factory instrumentation more effectively. In line with the growth of the Indian manufacturing sector, Honeywell continues to invest in its local production capabilities by doubling the operational space of the plant to 151 000 ft^2. The state-of-the-art facility enables HPS to provide enhanced expertise and training capabilities to customers and expand its production range.

KBR COMPLETES ETHYLENE REVAMP PROJECT

KBR Inc. has announced the successful completion of the ethylene plant revamp project for Korea Petrochemical Ind. Co. Ltd (KPIC) in Ulsan, South Korea. Under the terms of the contract, KBR provided its proprietary Selective Cracking Optimum Recovery (SCORE™) technology license, basic engineering design and proprietary equipment supply services to expand KPIC's existing plant ethylene capacity from 486 000 tpy to 800 000 tpy.

MCDERMOTT AND CB&I ANNOUNCE GLOBAL NAME AND BRANDS

McDermott International Inc. and CB&I have announced that, following the closing of the combination, the combined company intends to retain the name McDermott. CB&I's business that provides proprietary process technology licenses, associated engineering services, catalysts and engineered products, will use the Lummus brand name. Lummus also offers process planning, project development services and a comprehensive programme of aftermarket support, primarily for the petrochemical and refining industries. CB&I's tank business will keep its current branding.

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Table 4. Southeast Asia's proved oil reserves (billion bbls) (sources: BP, US Department of Commerce, IEA)

	2006	2015	2016
Vietnam	3.3	4.4	4.4
Indonesia	4.4	3.6	3.3
Malaysia	5.4	3.6	3.6
Brunei	1.2	1.1	1.1
Thailand	0.5	0.4	0.4
Rest of Southeast Asia*	0.1	0.2	0.2
Total	**14.9**	**13.3**	**13**

* Cambodia and Laos

Table 5. Indonesia's GDP and energy subsidies (source: Ministry of Finance)

	2016	2017	2018 (forecast)
GDP percentage	5	5.1	5.3
Government expenditure (trillion rupiah)	1149	1343	1454
Energy subsidies – fuel (trillion rupiah)	44	44	47
Energy subsidies – electricity (trillion rupiah)	63	45	48

Note: exchange rate: US$1 = 13500 rupiah

Table 6. PTTEP's 2017 financial results (US$ million)

	2016	2017	% YTD
Total revenues	4339	4523	4.2
Total expenses	3987	3929	-1.5
Net income	372	594	59.7
Sales volume (boe/d)	319 521	299 206	-6.4

the global economic growth and high global commodity prices," it said.

The World Bank said it expects Indonesia's economy to grow by 5.3% this year, up from 5.1% in 2017, due to the "continuation of strong investment growth and continued recovery in consumption."

Meanwhile, Indonesia's Central Statistics Agency said sharply higher export prices of LNG, coal and other commodities enabled the economy to expand at its fastest pace in four years. The 9.09% rise in export revenues for the year just about exceeded the 8.06% increase in import expenditure, according to the agency. Higher capital investment and government expenditure also contributed to the slight improvement in Southeast Asia's largest economy, which grew by just over 5% in 2016.

Slowing growth, rising oil prices

The World Bank report also expects the Indonesian economy to weaken as it is too dependent on commodity exports. "Sharper than expected declines in commodity prices could significantly weaken the country's terms-of-trade and exert downward pressure on external balances as well as government revenues, dragging on growth," the bank said.

According to the International Gas Union, Indonesia exported 16.6 million t of LNG in 2016, making it the world's fifth largest supplier. Asia's spot LNG prices recently climbed to a three-year high of over US$11 per million Btu – more than double the level in January 2017.

Ironically, higher oil prices are bad news for the country, which, despite owning one of Asia's largest oil reserves, lost its self-sufficiency in 2003 when it became a net importer. At around 600 000 bpd, Indonesia's oil deficit is still rising on account of its depleting reserves, falling production and growing consumption, which is currently estimated at more than 1.6 million bpd. Its oil reserves fell from 4.2 billion bbls to 3.3 billion bbls between 2010 and 2016, while production slipped from over 1 million bpd to 880 000 bpd, according to BP.

The country's declining oil self-sufficiency has led the World Bank to warn that a sharp increase in prices could "lead to higher inflation and reductions in consumer purchasing power, and/or a greater subsidy burden for the public sector."

Concurrently, the government has resumed increasing its spending on energy subsidies to help the country's large component of working class and poor among its 250 million population. "Reversing annual declines seen since 2015, the 2018 budget allocation for energy subsidies (fuel, electricity and liquefied petroleum gas) increased by 5.2% compared to the 2017," said the World Bank.

Pertamina, which is paying for the subsidies, wants the government to take over a greater share of the burden. Having lost an estimated 18.9 trillion rupiah in fuel subsidies in the first nine months of 2017, the company warned that its financial health will be threatened if oil prices continue to rise (US$1 = 13 500 rupiah).

Pertamina-PGN merger

In its search for energy security, Indonesia risks creating an uncompetitive giant from the planned merger of two of its largest state-owned oil and gas companies, said consulting firm Wood Mackenzie. The plan made progress on 25 January, when shareholders of gas transmission and distributing firm PGN voted to sell the government's 57% stake to integrated oil company Pertamina. The merger is expected to be completed in 1H18, paving the way for PGN to also acquire Pertagas, Pertamina's gas transportation and distribution subsidiary.

Pertamina, which reported revenues of US$36.5 billion in 2016, owns and operates the country's six main refineries, with a combined capacity of over 1 million bpd, and two LNG plants, with a combined annual production capacity of 24.5 million t. Last year, the company also produced more than 300 000 bpd of crude and condensate, as well as more than 2 billion ft^3/d of natural gas. It also owns a chain of retail outlets and storage terminals throughout the country. Pertamina controls more than 11 trillion ft^3 of the country's commercial and technical gas reserves.

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With revenues of US$2.93 billion in 2016, PGN is one of Indonesia's largest listed companies. The company mostly supplies gas to power companies. It operates 2050 km of transmission pipelines and 4114 km of distribution networks. Its upstream subsidiary, Saka Energi, holds around 1 trillion ft^3 of gas reserves.

A merger of these two companies, which own the bulk of Indonesia's oil and gas infrastructure, has been in the works for years as Jakarta wants to boost operating efficiency to meet the country's rising energy demand. Proponents argue that Indonesia needs a single state-owned giant to compete with other Asian state-owned firms and international majors.

The consolidation of Indonesia's numerous state-owned enterprises is in line with President Joko Widodo's reform programme to sustain the country's economic growth.

Wood Mackenzie's Senior Analyst, Edi Saputra, endorsed the plan for the 'synergies' accruing from the consolidation of the two companies' gas businesses, and the impetus it will provide for price reforms. However, he also expressed the fear that the new entity "could hinder competition" in the domestic gas market.

"Additional regulatory measures will be needed to prevent abuses of monopoly power," he said. Saputra has recommended that the new company's midstream business be unbundled and regulated under a third-party access scheme to ensure fair and unrestricted access for other players. "If not implemented, it could limit the marketing and negotiation options for upstream players."

Thailand

Buoyed by a near 60% surge in net profit in 2017, Thailand's largest oil and gas company, PTT Exploration and Production Pcl (PTTEP), the upstream arm of PTT, said it plans to boost its petroleum reserves by investing in upstream projects in Southeast Asia and the Middle East. The company reported net profit of US$594 million on total revenue of US$4.52 million, thanks largely to improved operations, cost control and a sharp rise in oil prices over the course of 2017. According to the US Energy Information Administration (EIA), the Brent crude price averaged nearly US$53.9/bbl last year – up more than 25% from 2016.

PTTEP, which is 51.1% owned by the Finance Ministry, said that after cost, it recovered an average price of US$39.2/boe from its petroleum sales in 2017. This was 9.2% higher than the 2016 average selling price of US$35.91/bbl.

The company's otherwise sterling performance was dampened by a decline in its natural gas sales volume, and a hefty loss of US$558 million from its Mariana oil sands project in Alberta, Canada.

In a filing to the Stock Exchange of Thailand, PTTEP said that its petroleum sales fell by 6.4% from 319 521 boe/d in 2016 to 299 206 boe/d last year. Nevertheless, the company ended the year on a strong financial footing, with cash reserves of US$4.7 million, enabling it to pay a dividend of 4.25 Thai baht per share to shareholders. (US$1 = 31 baht).

PTTEP's CEO, Somporn Vongvuthipornchai, said that the company has allocated US$1.77 billion for capital expenditure in 2018 to maintain production at 302 000 boe/d.

Hailing the company's "resilient" response to the market's volatile conditions, Vongvuthipornchai announced plans to accelerate final investment decisions on its minority stakes in three pre-development projects in Mozambique, Vietnam and Algeria in the coming months.

Vongvuthipornchai expects the Mozambique Rovuma Offshore Area 1 project to start up in 2023, with the potential to produce up to 12 million tpy of natural gas. The company's prospects will be further boosted by its stakes in Vietnam's Block B and 48/95, and Block 52/97, which are expected to start gas production in 2021 with the potential to reach 490 million ft^3/d. PTTEP expects the Algerian government to approve its plans to help develop the Hassi Bir Rekaiz oil and gas project. Combined with ongoing domestic upstream investments, PTTEP claims that these international projects will add to its oil and gas base of 631 million bbls of proved reserves, and another 400 million bbls of probable reserves.

PTTEP to buy Shell's stake in Thai gas fields

PTTEP is making good on a promise to expand its hydrocarbon reserves with an agreement to buy Royal Dutch Shell's combined 22.2222% stake in the Bongkot field and an adjoining acreage located off the coast of Thailand. Shell expects to complete the US$750 million transaction in 2Q18. Its stakes are currently held by affiliates Shell Integrated Gas Thailand Pte Ltd and Thai Energy Co. Ltd.

PTTEP, which operates the Bongkot field, will expand its stake to two-thirds, with France's Total owning the remaining one-third. Bongkot in the Gulf of Thailand produces approximately 860 million ft^3/d of natural gas and 26 000 bpd of condensate.

Vongvuthipornchai said PTTEP is also looking to buy into the Chevron-operated Erawan field as part of its mandate to increase the country's energy supply security. Chevron's concession in the field located in the Gulf of Thailand expires in 2022.

Malaysia

Royal Vopak has reported that its jointly-owned storage terminal in the southern Malaysian state of Johor is on course to begin operating in the 1H19. Pengerang Terminals (Two) Sdn Bhd (PT2SB), which is building the terminal to serve an integrated oil-petrochemical complex in the coastal town of Pengerang, passed a key phase when it secured a total of US$1.25 billion in financing from nine banks in December 2017. PT2SB's other owners are Malaysian state energy firm Petronas, engineering and construction firm Dialog Group Bhd, and the Johor state government. The lending syndicate includes AmInvestment Bank, DBS, ING Bank, Maybank, MUFG, Natixis, OCBC, SMBC, and UOB.

Vopak, PT2SB's operator, said that the fund will be used to pay for 80% of the project's US$1.6 billion cost, with the remaining 20% to be paid from equity contributions by its partners. In its initial phase, the terminal has the capacity to store up to 1.65 million m^3 of crude, refined products, petrochemical products and LPG. Equipped with 12 berths and water draft of 24 m to accommodate large crude

carriers, it will mostly serve Petronas's Refinery and Petrochemicals Integrated Development project (RAPID), which is now under construction.

In a statement, Voapak commented: "The financing facilities will have a final maturity of 15 years with a repayment schedule which starts after commissioning. The financing is initially based on variable interest rates and PT2SB will enter into financial hedge instruments to materially reduce the potential interest exposure."

Singapore

Buoyed by expectations for the region's sustained economic prospects, Singapore is hopeful that its bunker fuel sales will build on last year's record sales of 50.6 million t.

The World Bank has forecast that Southeast Asia's 10 economies will grow by a combined 5.2% this year, up from last year's 5.1% and 4.9% in 2016.

According to the Maritime and Port Authority of Singapore (MPA), the port's bunker sales surged by a stronger-than-expected 4.2% from 48.6 million t in 2016.

The industry had feared sales might slow following the MPA's decision to impose the use of mass flow meters (MFMs) at the start of last year to measure bunker fuel deliveries. The use of the MFMs is aimed at eliminating disputes between suppliers and buyers. The decision appears to have been vindicated, judging from the increased bunker fuel activities at the port.

Fuel sales have also been boosted by the 8.9% rise in container throughput through Singapore from 30.9 million twenty-foot equivalent units (TEUs) in 2016 to 33.7 million TEUs last year. The volume of cargo handled rose 5.5% to 626.2 million t.

"The increase in throughput was spurred by improvements in global trade growth and the repositioning of major shipping alliances," said the MPA.

Conclusion

Southeast Asia's energy security has weakened since the turn of the century, with little prospects for a turnaround in the coming years.

From being a net energy exporter with a surplus of more than US$9 billion in 2000, the region has become a huge net importer, sending its energy trade deficit to a new all-time high of more than US$20 billion last year, according to estimates by the IEA.

That deficit is on course to climb further as the region's energy appetite shows no signs of slowing down, while domestic production continues to decline and investors are reluctant to commit more funds to explore for new reserves. According to the IEA, Southeast Asia's oil demand will surge by 40% and natural gas by 60% through 2040. Over the same period, its oil production will plunge by a third while its natural gas output will remain unchanged.

In financial terms, Southeast Asia could see its net deficit in energy trade rise to more than US$300 billion in 2040, equivalent to around 4% of the region's GDP. Collectively, the long-term economic outlook of Southeast Asia's 10 nations will be at risk if they fail to plug the region's widening energy shortfall.

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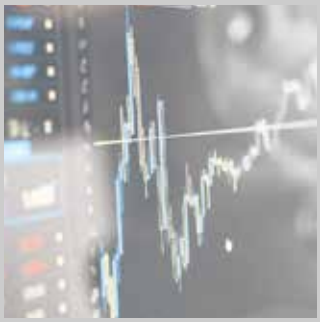

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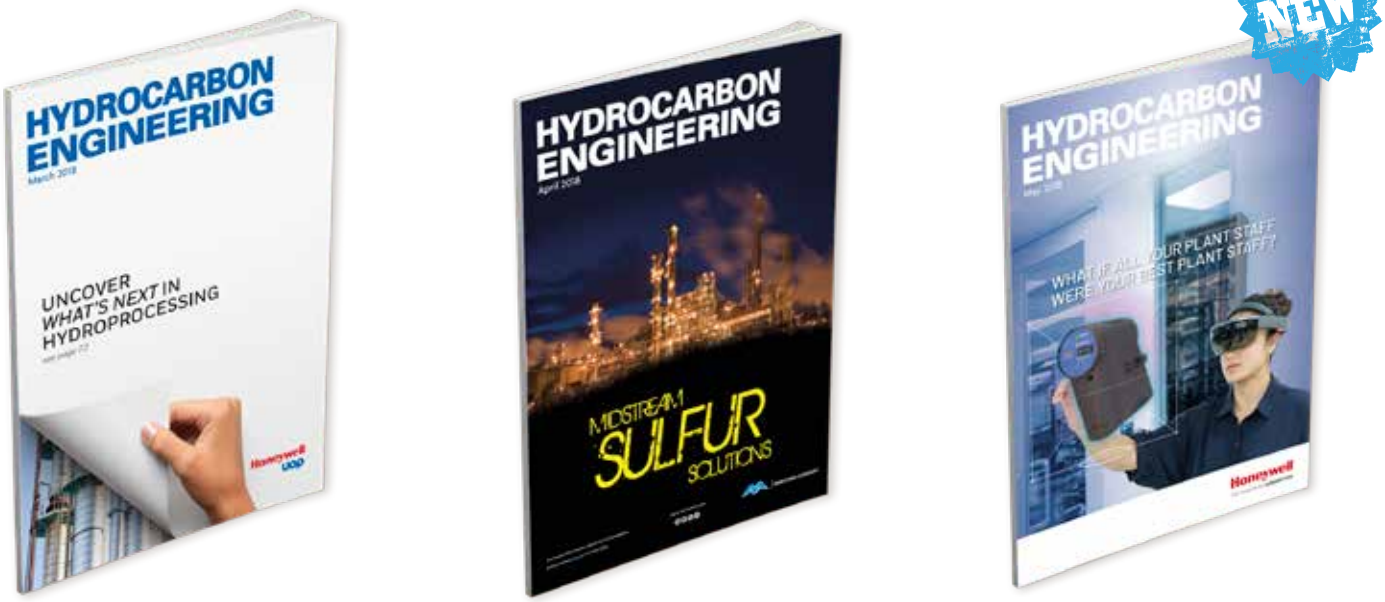

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